

IN THE CLAIMS

The following is a complete listing of the claims which replace any prior versions:

1 1-39. (Canceled)

1 40. (New) A method for providing precise control of a magnetic coupling field in

2 a NiMn top spin valve head, comprising:

3 forming a copper seed layer on a substrate;

4 forming a free layer on the copper seed layer;

5 forming a non-ferromagnetic layer on the free layer;

6 forming a copper spacer layer on the non-ferromagnetic layer;

7 forming a pinned ferromagnetic layer on the copper spacer layer; and

8 forming a NiMn pinning layer over the pinned ferromagnetic layer;

9 wherein the copper seed layer and copper spacer layer are oxidized separately during

10 formation.

1 41. (New) The method of claim 40, wherein the forming the copper seed layer

2 comprises depositing a layer of copper as a seed layer and, before depositing a next layer,

3 oxidizing the copper seed layer.

1 42. (New) The method of claim 41, wherein the forming the copper spacer layer

2 comprises depositing a layer of copper as a spacer layer and, before depositing a next layer,

3 oxidizing the copper spacer layer.

1 43. (New) The method of claim 40, wherein the forming the copper spacer layer
2 comprises depositing a layer of copper as a spacer layer and, before depositing a next layer,
3 oxidizing the copper spacer layer.

1 44. (New) The method of claim 40, wherein the copper seed layer and oxidized
2 spacer layer are naturally oxidized for 80 seconds under 8×10^{-5} Torr of oxygen pressure.

1 45. (New) The method of claim 40, wherein the oxidized copper seed layer and
2 oxidized spacer layer reduce the ferromagnetic coupling field without deteriorating GMR
3 effect or resistance.

1 46. (New) The method of claim 40, wherein the oxidized copper seed layer and
2 oxidized spacer layer provide a negative coupling field without affecting GMR effect or
3 resistance.

1 47. (New) The method of claim 40, wherein the oxidized copper seed layer and
2 oxidized spacer layer change the crystalline texture growth of subsequent layers.

1 48. (New) The method of claim 40, wherein the oxidized copper seed layer and
2 oxidized spacer layer provide a negative coupling field that is achieved without affecting a
3 GMR effect or resistance of the NiMn top spin valve head.

1 49. (New) The method of claim 48, wherein the oxidized copper seed layer and
2 oxidized spacer layer provide stronger growth of NiFe(111) and NiMn(111) with respect to
3 NiFe(200) and NiMn(002) phases.

1 50. (New) The method of claim 40, wherein the oxidized copper seed layer and
2 oxidized spacer layer improve the interfacial roughness.

1 51. (New) The method of claim 40, wherein the oxidation of the copper seed
2 layer and spacer layer does not affect asymmetry performance.